PATENT SPECIFICATION

1,012,139

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Date of Application and filing Complete Specification: June 25, 1962. No. 24315/62

Application made in Germany (No. S74605viia/8a) on June 30, 1961.

Complete Specification Published: December 8, 1965.

Index at Acceptance:—G3 R (2X, 7U, 9J, 31A, 37X).

Int. Cl.:—G 05 d.

COMPLETE SPECIFICATION

DRAWINGS ATTACHED

Method of and Apparatus for the Regulation of the Weighting Absorption of Fibrous Web Material

We, TEXMA MASCHINENGESELLSCHAFT M.B.H., trading as Gebruder Sucker, a German Body Corporate of Munchen-Gladbach, Rheinland, Germany, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method of and apparatus for the regulation of the weighting absorption of fibrous web material.

The weighting of fibrous web material is quite generally an operation in which the material is treated with a medium which remains on or in the material after the treatment. For example, the dressing of thread hanks is such a weighting operation, since the dressing remains on or in the threads after their passage through a dressing trough and a drying chamber. Other weighting methods are, for example, the application of glue to paper webs and the impregnation of cloth webs. It is desired to keep the weighting absorption, that is to say the ratio of the quantity of weighting medium to the quantity of weighted material, constant to a great extent. For the regulation of the weighting absorption of fibrous material conducted through a treatment container containing the treating medium a method has already been proposed wherein there is fed to the treatment container a greater quantity of treatment medium than the material is intended to absorb (referred to hereinafter as the desired value) and the quantity of treatment medium taken up (referred to hereinafter as the actual value) is determined from the excess quantity flowing away from the container. Such a method is not suitable in all cases for the measurement of the weighting absorption. For example, if the excess quantity is to small, the danger exists that outflow of the excess takes place irregularly and thus satisfactory measurement of such excess is not possible. If the excess quantity is too great, the measurement becomes too sluggish. This has an unfavourable effect especially when the measurement is to be used for the automatic regulation of the weighting absorption. Here it must especially be taken into consideration that the treatment medium is mixed with air bubbles in the passage of the web to be treated and consequently foams up.

The invention has for an object to avoid these disadvantages, and to this end there is provided a method of regulating the weighting absorption of a treatment medium by a fibrous web material passing through a container for said medium, which comprises supplying to said container a quantity of treatment medium equal to twice that which the material is desired to absorb, measuring the excess quantity of said medium, and adjusting the concentration to compensate for any difference between the desired value and the actual value of the absorption.

Preferably the quantity of treatment medium fed to the treatment container consists half of the excess quantity flowing out of said container and half of fresh treatment medium. In order that the weighting absorption shall be constant, the concentration of the fresh treatment medium can be adjusted automatically in dependence upon the said excess quantity. For this purpose, the ratio of the fresh medium to the excess can be varied by adding superheated steam to the fresh treatment

[Price 4s. 6d.]

medium. In place of super-heated steam it is also possible for hot water to be used or a combination of super-heated steam and hot water.

For the determination of the excess quantity, this can be transferred into an overflow container and the level in the overflow container can be measured. This measurement of the level in the overflow container has over the measurement of the level in the treatment container the advantage that the liquid surface area in the overflow container can be substantially smaller than the liquid surface area in the treatment container. The liquid surface area in the overflow container may be only $\frac{1}{4}$ to $\frac{1}{8}$ of the liquid surface area of the treatment container. This ratio of liquid surface areas between the treatment container and the overflow container leads to increased accuracy of measurement and thus of regulation. A rise in level in the treatment container of one half millimetre would thus result in a variation of level of two millimetres in the overflow container the liquid surface area of which amounts to only $\frac{1}{4}$ of that in the treatment container. Consequently the regulation by measurement of the level in the overflow container is considerably more finely sensitive.

The invention also provides apparatus for regulating the weighting absorption of a treatment medium by a fibrous material, comprising a treatment container, means to pass the material through said ,container pump means set to supply a quantity of treatment medium to said container equal to twice that which the material is desired to absorb, means to measure the excess quantity of treatment medium supplied to said container, and means to adjust the concentration of the supplied medium to compensate for any difference between the desired value and the actual value of the absorption.

The invention is illustrated by way of example in the accompanying diagrammatic drawings, wherein:

Figure 1 illustrates a part of a fibrous material impregnating machine embodying the invention; and

Figure 2 shows the level measuring device of Figure 1 in greater detail.

In Figure 1 there is shown the treatment container 1 containing the treatment medium, for example a dressing trough, through which the fibrous material F. for example a thread hank, is guided over dipping and squeezing rolls 2*a*, 2*b*, 2*c*, 2*d*. The treatment medium is supplied to the treatment container through a conduit 3. Excess treatment medium, i.e. medium not absorbed by the material, flows over a baffle 4, the height of which may be adjustable, into an overflow container 5. For the supply of the treatment medium to container 1 there are two delivery pumps 6 and 7, the pump 6 drawing medium from the overflow container 5 and the pump 7 drawing fresh treatment medium from a supply container 8. The two pumps 6 and 7 are so set that each supplies a quantity of treatment medium to the treatment container 1 equal to that which the material F is desired to absorb.

If, due to evaporation or for any other reason, the excess treatment medium should be less than that which the material is desired to absorb, so that its concentration is higher than is required, the concentration of the fresh treatment medium delivered by the pump 7 can be correspondingly reduced. For this purpose there is provided in advance of the container 1 a mixing container 9 to which the fresh treatment medium is fed from the pump 7 through a conduit 10. The mixing container 9 can be supplied with super-heated steam through a duct 11 and additionally with hot water through a duct 12. The duct 11 for super-heated steam is fitted with a variable, normally partially open remote control valve 14. The setting of the valves 13 and 14 takes place in dependence upon the quantity of the excess treatment medium flowing out of the treatment container 1 into the overflow container 5, which quantity can be determined by measurement of the level in the overflow container. For this purpose a float 15 within the container 5 co-operates with a measuring device 16 which is connected to an indicator and regulating device 17. In order to avoid an increased height reading of the float 15 due to adhering weighting medium (dressing), the float can be provided with a synthetic plastic coating, such as that known under the trade name "Teflon".

The assembly of the level measuring and regulating devices is shown in detail in Figure 2, which illustrates the overflow container 5 in side elevation. The float 15 is pivotally mounted at one end on the container 5 as shown at 18. The other end of the float carries a rod 19 pivotally connected to a lever carrying an armature 20 the position of which varies the inductance of two electro-magnets 21 and 22 according to the level of the float. This variation in inductance acts upon an indicator 23 of the apparatus 17, the pointer 24 of said indicator moving over a scale 25. Furthermore, the indicator is provided with two adjustable contacts 26, 27 which are connected through leads *a* with the remote control valve 13 for the super-heated steam duct 11. Another contact 28 is provided which, with the contact 26, serves through leads *b* for the remote control of the valve 14 for the hot water inlet.

For the regulation of the weighting

absorption the apparatus illustrated operates as follows:

In proportion to the speed of the thread hank F passing through the dressing trough 1, the pumps 6 and 7 are driven from a machine shaft 30 through gearings 61 and 71 respectively. The two pumps 6 and 7 are so set that they each deliver exactly a quantity of dressing liquid which is equal to that which the thread hank F is desired to absorb. In order to control these delivered quantities, the pumps 6 and 7 can be connected through valves 62, 72 to measuring devices 63, 73. In normal operation, the dressing medium taken by the pump 6 from the overflow container 5 is fed through a remotely controlled valve 31 to the dressing supply conduit. The pump 6 then merely effects a circulation of the dressing medium from the dressing trough 1 to the overflow container 5 and back to the dressing trough 1, this quantity of dressing medium corresponding to the actual quantity which is absorbed by the thread hank F. For the replenishment of the quantity of dressing actually absorbed by the thread hank F the pump 7 delivers to the mixing container 9 from the supply container 8 through a valve 33 a quantity of fresh treatment medium corresponding to the absorbed quantity. In the mixing container 9 there may be provided agitating means driven by a motor 34. The dressing medium delivered by the pump 7 is mixed with a specific quantity of super-heated steam through the duct 11, with or without the addition of hot water through the duct 12, which serves to compensate for heat losses occurring in the dressing trough 1 and moisture losses occurring as a result of evaporation.

If the concentration in the dressing trough 1 becomes too great for any reason, the thread hank takes up more dressing. Consequently a smaller proportion of dressing bath flows over the baffle 4 into the overflow container 5. The level in the overflow container 5 drops and with it the float 15, so that the indicator pointer 24 moves towards the right. Thus the contact 27 is actuated, which effects further opening of the steam valve 13. This further opening of the steam valve 13 is continued until the pointer 24 has disengaged from the contact 27 in the direction towards the zero position illustrated. If, despite the further opening of the steam valve 13, or because it is already fully opened, the concentration of the dressing liquid is not sufficiently reduced, so that the dressing absorption is still too great, the pointer 24 will actuate the contact 28, which opens the hot water valve 14 to the mixing container 9. Thus a further reduction of the concentration is achieved. As soon as the pointer 24 disengages from the contact 28 and returns towards the zero position illustrated in Figure 2, further opening of the hot water valve 14 is interrupted. When the pointer 24 has reached the contact 27 the hot water valve 14 is operated in the closing direction. After passing the contact 27 the pointer also interrupts the adjusting movement of the steam valve 13.

If the dressing bath has become too thin, too little dressing is absorbed by the passing thread hank F. Consequently a larger part flows over the baffle 4 into the overflow container 5, so that now the pointer 24 is moved towards the left and actuates the contact 26. The valve 13 is gradually closed, so that the supply of super-heated steam is reduced. The concentration of the dressing medium then rises, until the pointer 24 returns towards the right and disengages from the contact 26, when the closing movement of the super-heated steam valve 13 is interrupted.

In order to reduce oscillation phenomena in the regulating operation as far as possible, an impulse system is advantageously provided which has the effect that the actuating elements for the valves 13, 14 are not switched in during the entire closing time of the contacts 26, 27, 28 but are only switched in for a short time in each case and then are switched off for a corresponding time, so that the adjustment of the valves effected by said switching can first take effect. This impulse system can be arranged in the device 17.

For the examination and adjustment of the output from the pumps 6 and 7 there are provided the measuring devices 63 and 73, the quantity of medium to be delivered by the pumps being switched through the valves 62, 72 to said devices 63, 73. The pumps are then driven by an auxiliary motor 64. The number of strokes of the pumps is determined by adjustment in the speed of said auxiliary motor, and, in relation to measurement marks on the measuring vessels 63 and 73, this controls the quantity to be delivered by the pumps, which can be ascertained by reference to a table. If, for example, a warp with a metre weight of 100 g. is to be dressed and the dressing absorption is to amount to 150%, then for example 20 measurement strokes of the pumps are required. The pumps would then be correctly set when a measurement height of 300 mm. is produced in the measuring vessel. If the measurement height in the measuring vessels 63, 73 deviates from this level, adjustment of the pumps is necessary until the correct measurement height is produced.

During idling of the machine it can be advantageous to drive at least the pump 6 through the auxiliary motor 64, so that dressing circulation is maintained and the

formation of a skin is precluded. If the concentration of the dressing bath should become too great, the dressing delivered by the pump 6 is not conducted through the valve 31 but through a valve 32 to the mixer 10. During this time the squeezing roll 2*d* is relieved so that it does not rest with the same pressure against the roll 2*c* as in the normal operation.

When the machine is stationary the dressing regulation is switched off. However, the pump 6 is driven by the auxiliary motor 64, when the dressing to be circulated can be conducted through the valve 31 or through a valve 35 according to choice. The supply of the dressing to be circulated by the pump 6 through the valve 35 (with valves 31, 32 closed) can also be advantageous in those cases where an additional wetting of the thread hank F after leaving the squeezing zone between the rolls 2*b* and 2*c* is desired, since the valve 35 produces an additional dressing level above the rolls 2*b* and 2*c*.

In order, in the case of greatly fluctuating delivery speeds during normal operation, nevertheless to achieve a high accuracy in the adjustment of the pumps 6 and 7, the gearings 61, 71 can be formed as variable gearings, so that the speed of the pumps can be varied. In the case of high drive speeds and small delivery quantities from the pumps 6 and 7, an exact adjustment of the quantity of liquid to be delivered is very difficult due to unavoidable dead spaces within the pump housings. In this case it can be advantageous to reduce the pump drive speeds, for example to halve them, and to double the stroke, so that inaccuracies due to the dead spaces do not have such a great effect.

The float 15 may, if desired, be replaced by two level-sensing elements arranged at different heights in the overflow container. Instead of using super-heated steam, either alone or with hot water, for adjusting the concentration of the fresh medium, hot water alone can be used.

WHAT WE CLAIM IS:—

1. A method of regulating the weighting absorption of a treatment medium by a fibrous web material passing through a container for said medium, which comprises supplying to said container a quantity of treatment medium equal to twice that which the material is desired to absorb, measuring the excess quantity of said medium, and adjusting the concentration to compensate for any difference between the desired value and the actual value of the absorption.

2. A method as claimed in claim 1, wherein the quantity of treatment medium for the desired value of the absorption consists half of the excess quantity from said container and half of fresh treatment medium.

3. A method as claimed in claim 2, wherein the concentration of the fresh treatment medium is automatically adjusted in dependence upon the said measured excess quantity.

4. A method as claimed in claim 3, wherein the concentration of the fresh treatment medium is adjusted by the addition of super-heated steam and/or hot water.

5. A method as claimed in claim 4, wherein the fresh treatment medium is heated by the super-heated steam for heating the treatment medium in the treatment container.

6. A method as claimed in any one of claims 1 to 5, wherein the excess quantity is passed to an overflow container to which the level is measured.

7. Apparatus for regulating the weighting absorption of a treatment medium by a fibrous material, comprising a treatment container, means to pass the material through said container, pump means set to supply a quantity of treatment medium to said material equal to twice that which the material is desired to absorb, means to measure the excess quantity of treatment medium supplied to said container, and means to adjust the concentration of the supplied medium to compensate for any difference between the desired value and the actual value of the absorption.

8. Apparatus as claimed in claim 7, wherein the pump means comprises two pumps each set to supply a quantity of treatment medium equal to that which the material is desired to absorb.

9. Apparatus as claimed in claim 8, wherein one of the pumps is connected to a source of fresh treatment medium and the other pump is connected to recycle the excess medium from the treatment container.

10. Apparatus as claimed in claim 7, 8 or 9, wherein there is provided on the treatment container an overflow container having means for measuring the excess medium.

11. Apparatus as claimed in claim 10, wherein level measuring means is arranged in the overflow container.

12. Apparatus as claimed in claim 11, wherein the level means includes a float.

13. Apparatus as claimed in any one of claims 9 to 12, wherein the concentration of the fresh treatment medium is adjustable by means of a mixing container connected in advance of the treatment container, said mixing container having an inlet for superheated steam controllable in dependence upon the level in the overflow container.

14. Apparatus as claimed in claim 13, wherein the mixing container is additionally provided with an inlet for hot water which is controllable in dependence upon the level in the overflow container.

15. A method as claimed in claim 1

substantially as described.

16. Apparatus as claimed in claim 7 substantially as described with reference to and as illustrated in the accompanying drawings.

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Berwick-upon-Tweed: Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd.—1965
Published at The Patent Office, 25 Southampton Buildings, London, W.C.2 from which copies may be obtained.

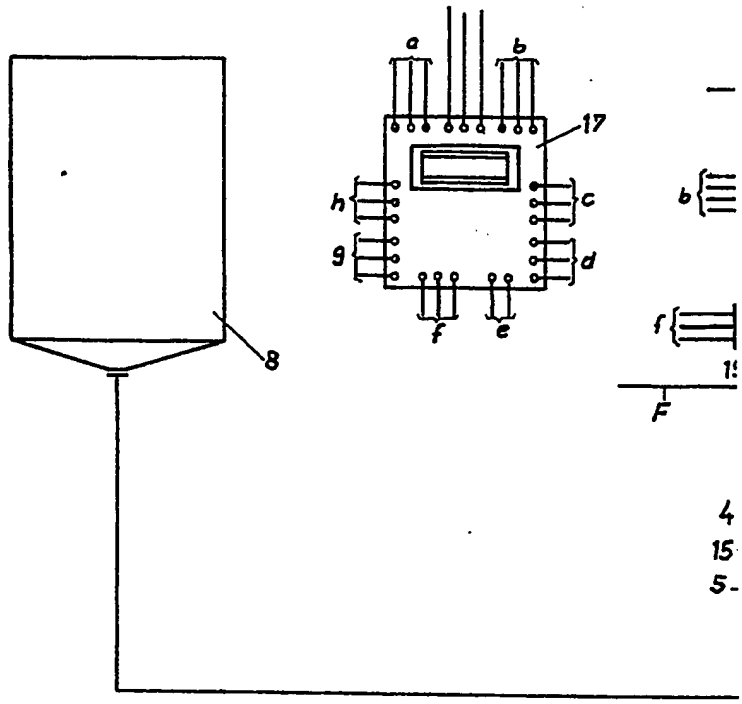
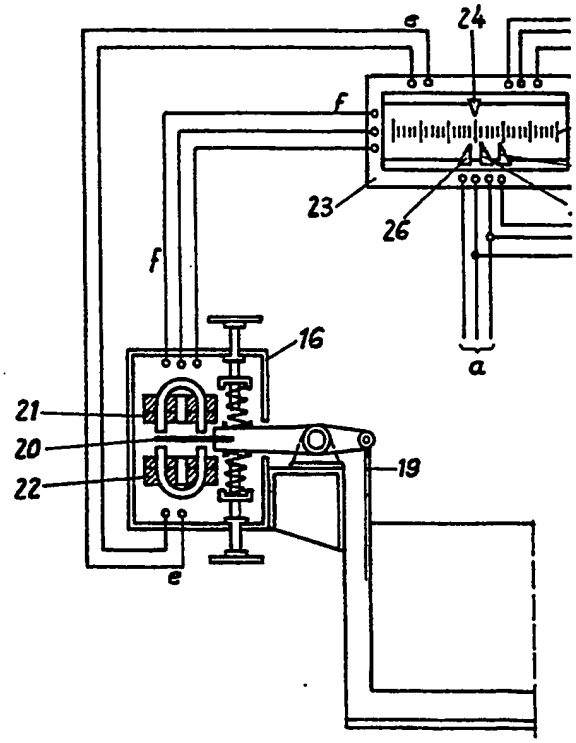


Fig. 1



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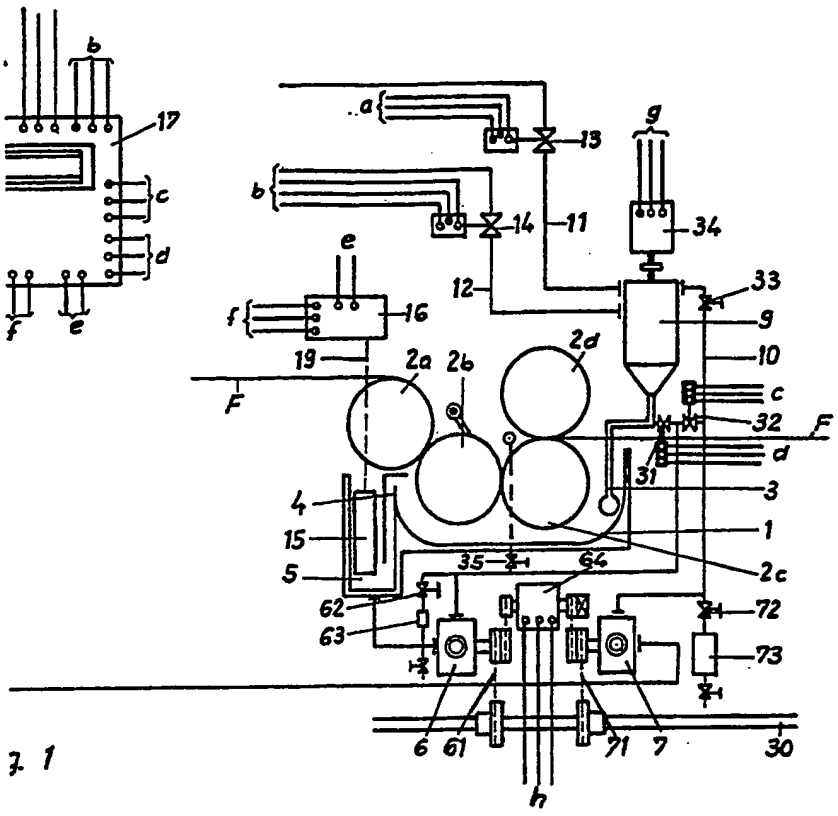

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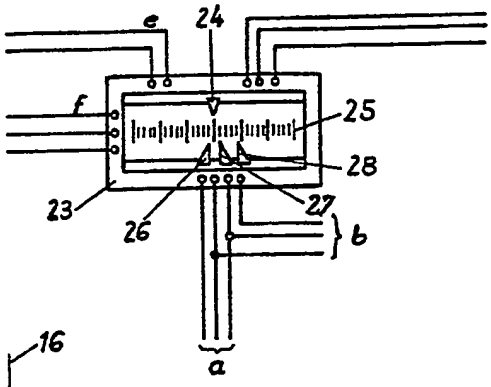
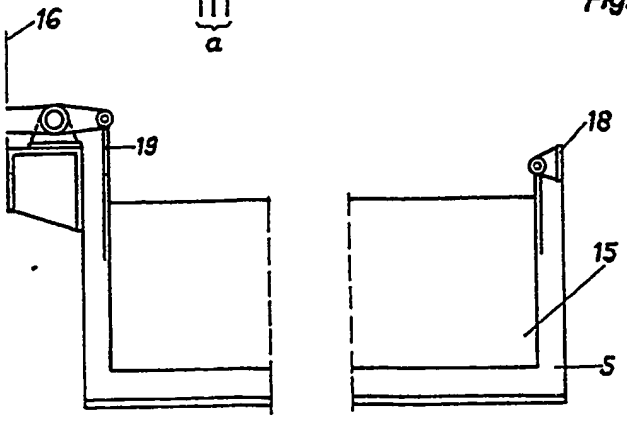


Fig. 2



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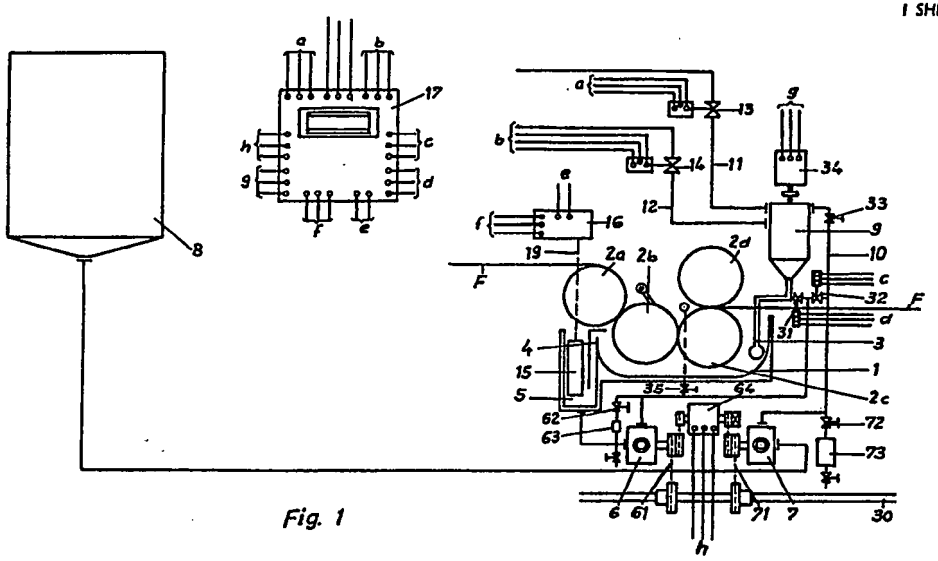

Fig. 1

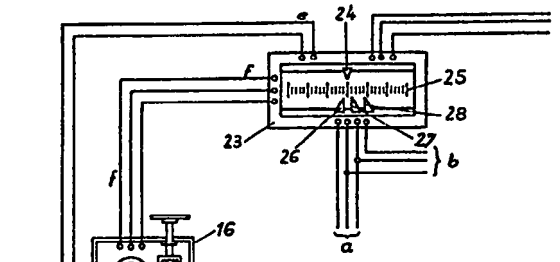

Fig. 2